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# Measuring savers' preferences how and why?

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## Abstract

Measuring individual preferences of savers have two main motivations: to reduce the share of non-observed heterogeneity in explaining households' wealth behaviors, and to construct more accurate tests of the theories of savings and portfolio choices.

For France, we have constructed a unique data set, the *PATER* surveys (*PATrimony and Preferences vis-à-vis Time and Risk*), with the first survey made in 1998 by interview with Insee, and the following surveys conducted by Tns-Sofres *via* postal questionnaires: *PATER*-2002 focused on the transmission of preferences between parents and children; the three subsequent waves, *PATER*-2007-2009-2011, were conducted in May 2007 (before the crisis), June 2009 and November 2011, on more than 3600 households representative of the French population, with an important panel dimension – about 2000 households were interviewed at least twice, and nearly 1100 households were present in all three waves. Almost each survey replicates direct measures of risk attitudes as well as time preference found in the literature, such as the hypothetical lottery on income of Barsky *et al.* (1997), self-reported 0-to-10 scales concerning the willingness to take risks in various contexts (Dohmen *et al.*, 2011), or even experimental measures. Yet these measures, based upon a limited number of questions, suffer from serious drawbacks that are analyzed in the paper.

This is why we have developed an alternative method of scoring in order to measure three types of preferences, towards risk, time, and offspring (altruism) : synthetic and ordinal *scores* of preferences are derived from the responses given to a large number of (mainly) simple real-life questions covering different life domains of life (consumption, leisure, health, investments, work, retirement, family). No single question is satisfactory by itself, but the idea is that if a number of questions possess a common dimension, towards risk for instance, this dimension will be isolated by aggregating the replies, beyond framing effects, measurement errors, etc.: the score obtained will then show enough internal consistency, as measured by psychometric tests. Ultimately, the data will thus determine how many indicators – if any – should be introduced for each type of preference.

On the five surveys, this scoring method has proved very consistent and robust. Derived from some 60 questions, one single score of preference towards risk was sufficient in each wave (with Cronbach's alpha near 0.7). As regards time depreciation, two scores were each time necessary, marking the contrast between the short term and impulsive choices ("short-term impatience") on the one hand, and the long term and more reasoned decisions "time preference" over the life cycle) on the other. One single score of altruism was retained. The contents of these four scores are very similar from one wave to the next, as well as their individual determinants, their individual correlation over time, the degree of correlation between scores, etc. Finally, the effect of these scores on the level and composition of wealth are similar across surveys, in line with theoretical predictions, and more significant than those obtained for alternate measures of preferences which suffer, moreover, from endogeneity biases.

## 1. Introduction: **PAT€R** or how to measure savers' preferences

The aim of this article is to propose a methodology for measuring the preferences of savers and for testing their impact on wealth management behaviour. In addition to the interest *per se* of such a study, it also sheds light on recent concerns shared by a whole school of thought. Over the last few years, the measurement of individual preferences in household surveys has assumed growing importance in what is called “household finance” (Guiso and Sodini, 2013), centred around two main motivations: to reduce the share of non-observed heterogeneity in explaining the accumulation and composition of household wealth, and to construct more accurate tests of the predictions made by economic theories of savings and portfolio choices.

To study these questions, we have access to a unique statistical source: the **PAT€R** surveys (*PATrimony and Preferences vis-à-vis Time and Risk*). **PAT€R** is an experiment that was launched fifteen years ago, and the first wave in 1998 was conducted by interview in collaboration with INSEE (the French National Institute for Statistics and Economic Studies). This first **PAT€R** survey of a thousand households was a complementary module to the “Patrimoine Insee 1998” survey, intended to supplement our information on the more subjective aspects of savers' behaviour (Arrondel, Masson and Verger, 2004). The idea was to compare our empirical measurements of preferences, based on an original method of scoring using a large number of questions, with the results obtained by the standard methods: lotteries, Likert scales and experimental measurements.

The ensuing waves were carried out by postal questionnaire, under the aegis of the polling organization TNS Sofres (see table 1). The second wave, **PAT€R**-2002, collected the information required to analyse the transmission of preferences between parents and children. The 2007 wave marked the maturation of our survey, allowing us to validate the contributions of our method of measuring individual preferences. The three subsequent waves, **PAT€R**-2009-2011-2012, were conducted in May 2007 (before the crisis), June 2009 and November 2011, on more than 3600 households representative of the French population, with an important panel dimension: about 2000 households were interviewed at least twice, and nearly 1100 households were present in all three waves. These surveys came at just the right time to follow the savers and also to analyse (Arrondel and Masson, 2013) the temporal stability of their preferences during the economic and financial crisis.

Each **PAT€R** questionnaire (from 1998 to 2011) includes a series of measurements of preferences obtained by different methods. Some of them, the “standard” methods, are those usually proposed in the empirical literature. The others stem from an original approach, based

on a scoring procedure which we first developed for the INSEE questionnaire of 1998 and which has undergone successive improvements since then. The idea is to use a large number of questions on various areas of life to construct synthetic and consistent ordinal measurements for each respondent – qualitative “scores” that evaluate their general attitude to risk and uncertainty (rather than their precise degree of aversion to risk, loss or ambiguity, for example), their degree of family altruism, and their time preference for the present – in which the data have led us to distinguish two components: the degree of short-term impatience and the time discount rate over the life cycle (or conversely the degree of long-term foresight).

Sections 2 and 3 detail the theoretical and empirical reasons that led us to adopt such a “heterogeneous” methodology for measuring preferences. Section 4 presents this scoring method, as it was first applied to the INSEE data of 1998: in particular, one single score is sufficient to characterise the preferences of savers with regard to risk and uncertainty, and likewise for family altruism; for attitudes to time, two separate scores had to be constructed, one for the long-term preference for the present and the other for short-term impatience. Section 5 describes the application of this method to the four other waves of the *PATÉR* panel and shows the surprising consistency and robustness of the results obtained: each time, four scores of preferences are sufficient, with contents that are very similar from one wave to the next; the individual determinants of the scores and the effect of these scores on the level and composition of wealth are comparable, etc. In addition to this robustness, exploitation of the successive waves of the *PATÉR* survey also demonstrate the superiority of our methodology compared with the other measures of preferences. Section 6 makes an appraisal of this experiment.

## 2. Individual preferences and models of the saver

The theoretical reference for the study of savers’ behaviour is the life-cycle model in its “standard” form. The saver is supposed only to derive satisfaction from the global volumes of his own consumption at each period in his life, and this determines his life-cycle saving. He can also have a motive of transmission, which is a function of his degree of “altruism”  $\theta$  and which is assumed to be separable from his life-cycle saving.<sup>1</sup> Wealth management choices are assumed to be independent (not influenced by the behaviour of others), purely forward-looking and time-consistent.

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<sup>1</sup> The form of this altruistic motive can vary: the parents may derive satisfaction from the value of the bequest they make (before or after tax), or they may be directly concerned by the well-being of their children.

## 2.1. The parsimony of the “standard” life-cycle model: 3 preference parameters

More precisely, the model is based on the maximisation of a time-additive utility function  $U$ , where the instant utilities,  $u_t(C_t)$  at period  $t$ , are discounted at a constant exponential rate representing the future discount rate<sup>2</sup>  $\delta$ . Moreover, since life-cycle saving is simply deferred consumption, which does not in itself provide any utility, intertemporal consumption preferences can be assumed to be homothetic: it follows that the instant utility is of invariant and isoelastic form, that is to say  $u(C) = C^{1-\gamma}/(1-\gamma)$ . The parameter  $\gamma$  represents the degree of concavity of  $u$  or the elasticity of the decreasing marginal utility. It is the inverse of the intertemporal elasticity of substitution, and can also be interpreted as the desire to smooth consumption over time. In an uncertain world, finally, it is assumed that the saver maximises his expected utility function, so that the parameter  $\gamma$  can be interpreted as the (constant) level of risk aversion; it also determines the saver’s level of prudence (i.e. his precautionary savings) and his level of temperance (i.e. the degree to which the presence of an exogenous risk – on his labour income, for example – reduces his risk-taking, notably in his portfolio choices).

So the standard life-cycle model is particularly parsimonious. Wealth management choices are considered to depend on just *three* independent preference parameters, which determine the individual’s attitudes to risk and uncertainty, time, and children (inheritance):

- $\gamma$  determines, more precisely, the smoothing of consumption over time and attitudes to risk;
- $\delta$  defines the reduction, for a given life expectancy, in the degree of foresight and the decision-making horizon;
- $\theta$  determines the degree of intergenerational altruism.

The effects of these preferences on wealth management choices are clear: wealth increases with  $\gamma$  (precautionary saving), decreases with  $\delta$  (life-cycle and retirement savings), and increases with  $\theta$  (savings intended for inheritance); the share of risky assets decreases with the aversion to risk  $\gamma$ .

Often obscured, the central message of the standard model with regard to preferences is, however, more subtle. Although this model makes a clear separation between the preferences concerning risk ( $\gamma$ ), time ( $\delta$ ), and children ( $\theta$ ), wealth management choices are highly dependent on the *interaction* between these parameters: knowing only that the individual is relatively tolerant to risk, or only that he is short-sighted, provides no more than limited knowledge; knowing that he is both at the same time – what we will call a “hot head” – tells us much more about his savings decisions and the composition of his wealth. So, by

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<sup>2</sup> This future discount rate may in fact depend on the age of the individual but not on the distance from the present (as in the case of hyperbolic discounting).

combining the preferences with regard to risk and time, we can distinguish four different regimes of wealth accumulation (and composition) in the standard model:

- the “Conservative investors” (high  $\gamma$ , low  $\delta$ ), cautious and far-sighted, adopt a wealth management profile typical of the life cycle, combining life-cycle (“hump”) saving and precautionary saving (Modigliani, 1986);
- the “Short-sighted prudent” (high  $\gamma$ , high  $\delta$ ), risk-averse but short-sighted, aim at a certain level of precautionary saving over the medium term (target saving): they follow a “buffer-stock” model (Carroll, 1992; Deaton, 1992) whereby they create a reserve of money to protect against unforeseen falls in their labour income;
- the “Hotheads” (low  $\gamma$ , high  $\delta$ ), risk-tolerant and short-sighted, are the perfect candidates for “rational addiction” (Becker and Murphy, 1988) in an uncertain environment; their regime of accumulation has not yet been fully characterised;
- the “Enterprising” (low  $\gamma$ , low  $\delta$ ), risk-tolerant and far-sighted, constitute the neoliberal ideal of the entrepreneur; the characteristics of their regime of accumulation also remain somewhat unclear.<sup>3</sup>

Despite these theoretical riches, the standard model is too simple to have more than limited predictive power. It cannot explain the insufficient retirement saving of part of the population. And even taking into account the transaction costs and other imperfections of the capital markets, and the limited access to information, this model generates portfolios that are much more diversified than those observed in reality: in particular it cannot explain the loss of interest in life annuities, nor the limited diffusion of shares within high financial assets, which ought to offset the effect of transaction costs.<sup>4</sup>

## 2.2 The limitations of more realistic non-standard models: too many preference parameters

To make up for these shortcomings, but also to explain the results obtained in experimental economics, “non-standard” models have been developed, introducing numerous other preference parameters. As far as risk is concerned, these parameters most often stem from rejection of the expected utility model:

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<sup>3</sup> This typology of savers can be further refined by distinguishing between the “altruists” and the “egoists” in each group, or by incorporating the degree of short-term impatience  $\beta$ , a “non-standard” parameter examined below, which introduces a time-inconsistent preference for the present: the Ulysses of the *Odyssey* is typically an impatient Enterprising; the impatient Hotheads (of whom Achilles in the *Iliad* is a good example) are characteristically subject to a chronic lack of money, repeated payment or credit defaults, etc.

<sup>4</sup> See Masson (2010a) and Arrondel and Masson (2011).



- The degree of *optimism or pessimism* of the individual, according to the (non-linear) way he transforms the probabilities of risky events, helps, in particular, to explain “anomalies” in the demand for insurance.<sup>5</sup>

- *Loss aversion* means that to judge the profitability of a risky financial operation, the individual makes his decision on the basis of a reference value – initial wealth in the simplest cases – in relation to which he evaluates profits and losses differently: the disutility of a loss is greater (in absolute value) than the utility of an equivalent profit (Kahneman and Tversky, 1979). Loss aversion is a notable theoretical advance, but it requires the introduction of at least three new parameters of preference.

- The *aversion to ambiguity* leads individuals to prefer less favourable situations when the probabilities of an event are not very well known: this helps to explain the low demand for foreign shares, but also the loss of interest in life annuities, because of individuals’ lack of knowledge about their probabilities of survival, which are highly idiosyncratic.

As far as attitudes to time are concerned, the non-standard models reject above all the hypothesis of time-consistent choices, considering savers only to have limited rationality:

- *Quasi-hyperbolic discounting* causes an additional depreciation of the immediate future, that is to say  $1-\beta$ , which means that individuals are tempted to over-consume in the present. The parameter  $\beta$  may express either a lack of imagination and clear-sightedness, leading to procrastination, where people continually put off disagreeable chores or resolutions till tomorrow (Akerlof, 1991), or a lack of willpower and self-control, when the subject cannot respect the rules that he initially set for himself (Laibson, 1997).<sup>6</sup>

- More generally, savers are considered to be victims of their *emotions*. Some of these can distort their attitude to time, like the general desire for improvement in the future (in favour of profiles of increasing consumption) or phenomena of expectation revealing a bias towards the future, such as savouring the anticipation of a happy event that one defers, or dreading a painful experience that one seeks to be done with as quickly as possible. Other emotions are held to be responsible for a systematic aversion to divestiture (the endowment effect) or a retrospective over-sensitivity to irrecoverable past costs (the sunk costs fallacy), etc.

- Even worse, savers are considered to suffer from a lack of financial education or limited cognitive capacities. They make “mistakes” of all kinds: of calculation, strategy, and anticipation in the gathering and processing of information or in the formation of their beliefs: non-Bayesian revision, overconfidence in their judgement, inability to plan for the long term,

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<sup>5</sup> Individuals are not risk-neutral for small risks, contrary to the predictions of the expected utility model, which has linear probabilities.

<sup>6</sup> Contractual (blocked) savings would have more success with these impatient individuals (high  $\beta$ ) who are also far-sighted (low  $\delta$ ): they would like to impose some discipline on themselves, make a pre-commitment, by temporarily freezing some of their assets or binding themselves to regular payments.

etc. Even more than quasi-hyperbolic discounting (parameter  $\beta$ ), these different “biases” highlighted by behavioural economics could explain an inadequate preparation for retirement. In addition, decisions may be too dependent on framing effects or mental accounting, where individuals impose constraints on their spending by allocating their resources to different, relatively non-fungible mental accounts, for example “current income”, “current wealth” and “future income”, with decreasing marginal propensities to consume (Shefrin and Thaler, 1988).

In terms of the practical measurement of savers’ preferences, these “non-standard” theoretical developments raise two substantial difficulties.

Firstly, and especially in terms of risk, the theory proposes to take into account an excessive number of parameters of preference – of which the list given above is far from exhaustive. These parameters all appear to be relevant, but their empirical estimation requires very particular and often over-abstract conditions, with the risk of increasing measurement errors or obtaining results that cannot be exploited; in this respect, the financial incentives offered in experimental economics are of limited assistance.

Secondly, even the most sophisticated non-standard models have difficulty explaining the most striking stylised facts of wealth management choices. And we are not talking about the behaviour of experienced investors here, but that of “ordinary” French savers, which is characterised in particular by:

- (i) notoriously insufficient retirement savings in nearly one in four cases;
- (ii) a loss of interest in life annuities, which remain, despite their imperfections, a profitable product in the context of life-cycle saving;
- (iii) limited diffusion of risky products like shares.

For these three criteria, the non-standard models do, admittedly, perform much better than the standard version: they can explain certain cases of insufficient retirement saving, and they predict the much lower amounts possessed in the form of life annuities or shares. But they are incapable of explaining the low levels of accumulation in households with relatively high cognitive capacities, qualifications and incomes. Above all, they cannot really explain why a large majority of households possess neither life annuities nor shares (Masson, 2010a). Thus, only 15% of French households are direct owners of shares today, and this cannot always be blamed on transaction costs, because the figure remains low even among highly-educated households and those with high (financial) wealth. Of course, the unfavourable economic climate, which reduces household expectations on future share prices, partly explains why there is such a low proportion of shareholders among households;<sup>7</sup> but this proportion has

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<sup>7</sup> The second part of this text deals precisely with changes in expected asset prices during the current crisis (May 2007 to November 2011).

never risen above one quarter, even during periods of stock market prosperity and economic growth.

### **2.3. The limitations of theory call for an *empiricist* method of evaluating preferences**

These two shortcomings of the theory – the profusion of preference parameters that are difficult to isolate and the inadequacy of model predictions – mean that any questionnaire aiming to “collect the necessary information to carry out a [complete?] reliable quantitative and multidimensional evaluation of investors’ preferences” is doomed to failure from the moment one considers the wealth management choices of all French savers.<sup>8</sup> This justifies our choice of a less ambitious and above all more empiricist method of measuring preferences, from two points of view:

- (1) We only seek to evaluate three “types” of savers’ preferences, relating to risk or uncertainty, time and children, without concerning ourselves too much about what it is the questions asked about attitudes to risk, for example, actually evaluate: risk aversion in the strict sense of the term, the degree of caution or temperance (in the context of expected utility), aversion to loss or ambiguity, the level of pessimism/optimism, etc.
- (2) The complexity and diversity of the phenomena to be measured requires a considerable number of questions to be used at the outset, in order to determine *ex post*, for each type of preference, the number of different indicators to be introduced according to the respondents’ answers rather than theoretical *a priori*s. Ultimately, it is the data that decide: they might just as well show that the relevant distinction in terms of risk lies not in the contrast between aversions to risk, loss and ambiguity, but in the subjects’ differing reactions to small risks and large risks, in which case the replies to essential and non-essential decisions could not be treated on the same level.

### **3. The usual measures of preferences are unsatisfactory**

Today, the economic literature proposes a wide variety of measures of preferences concerning risk. The range of estimations of time preferences is more limited. But very few studies evaluate both types of preferences at the same time, despite the fact that combining them provides much more information about wealth-management behaviour (see above). Lastly, the degree of family altruism is generally not taken into account.

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<sup>8</sup> And yet this is the declared ambition of Palma and Picard (2012), from whom the above quotation is drawn (translated from the French).

These measures can be differentiated according to whether the information gathered is based on *surveys* of households or *experimental* data. The measurements obtained in surveys have the advantage of concerning large, representative samples but – and this issue has provoked debate – they do not involve any financial incentives. Many of them were collected during certain waves of the *PATÉR* survey; they often aim to evaluate a type of preference, concerning risk or time, rather than identifying a specific preference parameter, such as loss aversion, for example.

Directly inspired by theory, experimental studies generally take the form of hypothetical choices (between lotteries, for example) that are calibrated to measure a clearly-defined preference parameter. The disadvantage is that these questions are often complicated and abstract and only cover small samples. Experimental measures, even combined with financial incentives, also raise the issue of the transposition of behaviour between *in vitro* and *in vivo* data: this crucial problem is already present in the case of attitudes to risk, but we will see that it is even more acute in the case of time preferences, because it is so difficult to reproduce real-life time in the laboratory.

We will start by looking at the measures of attitudes to risk. They can be differentiated according to the area of life considered. Those directly concerning financial investments are *a priori* the most relevant, but their effects on the accumulation and composition of wealth suffer from obvious endogeneity biases. Others focus on different areas, such as income, health or sport. Others are meant to be more synthetic, either by considering the life of the individual “in general” or by summarising the answers to a series of questions relating to particular domains, in the manner of psychological questionnaires (Weber *et al.*, 2002).<sup>9</sup>

We will then look at how the usual measures of attitudes to time are much more fragile, due to the difficulties raised by the very concept of preference for the present, which is generally misunderstood. This preference, which directly compares today’s satisfactions with those of tomorrow, is of a “higher order” because it concerns the ends pursued: expressing the particularity of human subjectivity, it decreases with the scope and scale of the saver’s projects which give meaning and substance to his existence and thereby determine one’s relation to one’s future self.

### 3.1. The Barsky *et al.* (1997) lottery involving career choices

The most well-known and widely-used measure of attitudes to risk is that first proposed by Barsky *et al.* (1997). It is based on hypothetical choices of lotteries concerning the

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<sup>9</sup> This approach presupposes the stability of attitudes to risk in different domains: is there some kind of “general behavioural disposition” with regard to random situations, more or less independent of the domain considered? Or should we, on the contrary, emphasise the substitution between risks, which explains why a saver who has chosen a “risky” profession might “moderate” the risk-taking in his wealth management.

individual's permanent income. Each subject is offered different employment contracts in place of his current one,<sup>10</sup> generating a life-cycle income of  $R$ : for example, a contract where he has a  $1/2$  probability of doubling that income and a  $1/2$  probability of only earning  $\lambda R$  ( $\lambda < 1$ ).

In the standard framework of expected utility, an individual with an isoelastic utility function  $V$ , with elasticity  $\gamma$ , will prefer to keep his income  $R$  if and only if:  $1/2V(2R) + 1/2V(\lambda R) \geq V(R)$ . By varying the value of  $\lambda$ , it is then possible to deduce an interval for the relative risk aversion  $\gamma$ : for example, if the individual refuses the contract for  $\lambda = 2/3$  but accepts it for  $\lambda = 4/5$ , then the value of  $\gamma$  lies in the interval  $[2; 3,76[$ .

The hypotheses of the standard model may be unrealistic, but there is no reason why we should not interpret the measurement as a qualitative indicator of the general attitude towards risk rather than a quantitative evaluation of relative aversion in the strict sense of the term. What is important is that the method allows classifying individuals into four or six categories, from the most risk-tolerant to the most risk-averse.

In the first wave of the US Health and Retirement Study (HRS) in 1992, about two-thirds of American households (aged 50 years old or more) were classified in the most risk-averse and about 12 % in the most risk-tolerant category. Risk tolerance fell substantially with age and was higher for men than for women.<sup>11</sup> This variable helps to explain risky behaviour (consumption of tobacco or alcohol, self-employment, demand for insurance and risky assets, etc.) statistically, but its explanatory power remains fairly weak.

This lottery has been the subject of numerous criticisms. It only concerns the domain of professional life, and it depends on the current situation of the respondent, especially the level of risk in his financial portfolio (substitution of risks). The questions asked, based on a hypothetical situation, are too abstract and artificial (10 % of the sample refused to participate in the lottery). And lastly, the answers are unstable and subject to a lot of noise, with a rank correlation of only 0.27 for the same individuals in the first two waves of the HRS (1992 and 1994). However, replication of the lottery in the different waves of the HRS has made it possible to control for these estimation biases and to obtain *ex post* corrected measures that are much more reliable and better at explaining risk behaviour (see Appendix 1).<sup>12</sup>

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<sup>10</sup> The initial wording of the American HRS (in 1992 and 1994) simply asked the subjects to choose between the contracts proposed. To avoid *status quo* bias, due to the fact that some individuals are reluctant to change jobs, a different form of questioning was drafted for subsequent waves: the subjects were asked to imagine they were in a situation where they had to move for health reasons and therefore to change jobs.

<sup>11</sup> Barsky et al. (1997) also showed that risk tolerance varies with race and religion: "Whites are believed to be the least risk tolerant. Blacks and Native Americans, at the same time, are somewhat more risk tolerant, whereas Asians and Hispanics are the most risk tolerant" (p. 550); in terms of religion, Protestants are the least and Jews are the most risk-tolerant, with Catholics occupying a position about halfway between the two.

<sup>12</sup> However, the greater risk tolerance of better-educated respondents may be partly due to their greater ability to understand complicated questions – a bias that is difficult to correct (see Borghans *et al.*, 2008).

### 3.2. Likert-type scales of risk

Other measures are based on self-reported scales where the subjects are asked to evaluate their propensity to take risks on a scale of 0 to 10. This method is quite widely used and easy to implement in surveys. These scales can be defined “in general” or concern specific areas of life, such as health, sport and leisure activities, professional, financial, etc. Purely subjective, they measure an undifferentiated attitude to risk. However, the subjects do not have any points of reference or their evaluation: thus, the figure “5” can mean very different things to different individuals, in the absence of detailed ‘vignettes’.

In particular, this method was used on German data by Dohmen *et al.*, (2011) and Ziegelmeyer (2010). Older subjects and women were found to be less tolerant to risk. Scales of risk allow explaining a whole range of behaviours related to risk, from the consumption of tobacco to the choice of portfolio, and from the practice of sport to the choice of professional activity. Dohmen *et al.* (2012) obtain a positive correlation between the replies of parents and the replies of their adult children.

### 3.3. Measures of risk based on hypothetical financial choices

Other subjective measures are drawn from simple *ad hoc* questions concerning financial strategies or choices, risky or not. They date back to the 1983 wave of the American Survey of Consumer Finance (SCF), in which individuals were asked to choose between several different investment options, ranging between “taking substantial financial risks expecting to earn substantial returns” and “not willing to take any financial risks”. More recently, similar questions have been proposed by Iezzi (2008) and Guiso and Paiella (2008) on Italian data, Kapteyn and Teppa (2011) in the Netherlands, and Weber *et al.* (2013) in Great Britain.

The measure of Iezzi (2008) is an indicator of risk aversion that distinguishes four groups of investors on the basis of a series of risk-return trade-offs on assets like in the American SCF. This indicator explains the probability of owning risky assets. In the same vein, Guiso and Paiella (2008) built a measure of absolute risk aversion based on the maximum amount that Italian subjects were prepared to invest in a risky asset with the same probability of yielding a given capital and of losing everything. They found that absolute aversion decreases with the individual’s level of resources but does not depend on his other characteristics. Furthermore, exposure to income risk leads subjects to invest less in the risky asset, revealing temperance behaviour (substitution of risks).

Kapteyn and Teppa’s (2011) synthetic measure is based on the subjects’ answers on scales from 0 (“complete disagreement”) to 7 (“complete agreement”) to questions about investment, such as: “I want to be certain that my investment is safe” or “I would never consider investments in shares because I find this too risky”. Likewise, Weber *et al.* (2013)

evaluate the attitude to risk of Barclays Bank customers based on Likert scales, graduated from 0 (“strongly disagree”) to 7 (“strongly agree”), in response to questions such as: “I am a financial risk-taker” or “It is likely I would invest a significant sum in a high risk investment”.

This type of questioning is less artificial, but it raises two problems. The first, of a theoretical nature, is that the measure, which concerns a generic attitude to risk, cannot be matched to any precise preference parameter in the models – the very limitations of the theory explain this imprecision. The second problem is more troublesome: a measure based on financial questions is obviously subject to endogeneity biases when it is used to explain wealth management choices. Despite these biases, Kapteyn and Teppa conclude that their measure of attitudes to risk has greater explanatory power than the lottery of Barsky *et al.* (1997) for explaining the demand for risky assets.<sup>13</sup>

### 3.4. Experimental measures of risk preferences

Lastly, experimental measures are becoming more and more popular because they are obtained from lottery choices with real financial incentives – “live” conditions. They also allow for better control of “wording” effects and framing effects. Moreover, they measure *a priori* a specific preference parameter drawn directly from the theory (risk aversion in the strict sense of the term, loss aversion, aversion to ambiguity, etc.).

Most often, experimental measures of risk aversion in the form of prize lotteries are based on the kind of procedure proposed by Holt and Laury (2002): the choice between a certain gain and a risky lottery is repeated, gradually increasing the prize until the subjects choose the lottery. Dohmen *et al.* (2011) use this procedure on a subsample of the German survey: they find a significant positive correlation between their general scale of attitudes to risk and this experimental measure, although the correlation is fairly weak.<sup>14</sup> This measure does help to explain certain risk-related choices, but less satisfactorily than the Likert scale.<sup>15</sup>

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<sup>13</sup> These endogeneity biases reach a peak of intensity in Palma and Picard (2012), in which the measures of risk aversion and loss aversion are obtained from hypothetical choices between a risk-free investment and a risky asset with given characteristics. Beyond the interpretation of the answers in terms of risk or loss aversion, it all ultimately amounts to testing the internal – “rational” – consistency of the choices made *in vitro* and *in vivo*, forgetting, in particular, that the aversion to ambiguity plays a central role in real behaviour.

<sup>14</sup> On a subsample (400 individuals) of the *PATÉR*-2007 survey, Cohen *et al.* (2010) apply a similar experimental measure of risk aversion, which is also positively but weakly correlated with the other measures of risk preferences (although more strongly with the scoring method than with scales or lotteries). The authors apply a similar procedure to measure the aversion to ambiguity (see appendix 1), again obtaining a weak correlation between aversion to risk and aversion to ambiguity: however, the explanatory power of these two measures on portfolio choices is weak.

<sup>15</sup> On a representative sample of Dutch households, the experimental study by von Gaudecker *et al.* (2011) measures four preference parameters related to risk: risk aversion, loss aversion, the Kreps-Porteus preference for early or late resolution of uncertainty, and the tendency to choose “at random”. All these parameters have explanatory power for risk choices made in the laboratory (with financial incentives), but the study has no information on the subjects’ real wealth management choices.

### 3.5. Measures of attitudes to time pose a conceptual problem

Contrary to attitudes to risk, the time preference for the present in the context of the life cycle immediately poses a conceptual problem. For many important authors, both economists (Ramsey, Harrod, Sen, Tobin) and philosophers (Nagel, Rawls), a pure and rational time preference cannot be justified over a *finite* horizon like that of human existence: in other words,  $\delta = 0$ .

How, then, should we interpret the empirical measures of time discounting, of which the critical review by Frederick, Loewenstein and O'Donoghue (2002) proposes an almost exhaustive list, revealing the huge variation in estimations from one study to another: between - 6 % and 200 %?

The measures obtained in surveys, usually econometric, rarely allow to isolate a pure preference for the present because they are contaminated by many other parasitic factors: for example, the discount factor  $\delta$  must be confused neither with the interest rate (as in trade-offs between monetary gains and losses at different dates), nor with the marginal intertemporal rate of substitution in consumption; nor must the measure express the effects of future uncertainty – “I would rather have one today than two tomorrow, because the former is certain, the latter uncertain”.

Experimental measures (with monetary incentives) are supposed to control such factors. Some of them have been adapted from the procedure of Holt and Laury (2002) for risk choices: successive choices are proposed to the subjects, gradually increasing the “reward for waiting”. The value of the preference for the present is then determined by the moment when the individual opts for the future. Dohmen *et al.* (2010) applied this kind of measure, which they related to the subjects' cognitive capacities; Cohen *et al.* (2010) built a similar measure on a subsample of our French *PATÉR*-2007 survey. The rather disappointing nature of the results (notably the weak explanatory power for wealth management choices), stems from the fact that these estimations still include irrational subjective elements – emotions, framing effects, dread, savouring anticipation, etc. – and only concern the short term: in fact, they suffer above all from the virtual impossibility of reproducing real-life time in the laboratory.

This shortcoming becomes a major disadvantage when one adopts an “existential” view of (rational) time preference over the life cycle, which is the only way really to justify a positive  $\delta$  (Masson, 2010b). If, like Rawls, one adopts an external and objective view of one's own life, there is no reason not to pursue an equitable or symmetrical treatment of its different moments – except for the probabilities of survival. In that case, a rational preference for the present can only be justified by the particularity of human subjectivity, which finds expression in one's relation to one's future self and in projects that give meaning and



substance to one's life *today* (marriage, career, buying a home, the children's education, retirement, etc.): "man is a project who decides himself" (Sartre). This is because the continuity of life (i.e.  $\delta = 0$ ) is not self-evident: one's "future selves" only really *exist* for the present self if this latter currently has reasons to live, federative projects that involve these future selves so that he cares about these more or less distant replicas of himself, he is concerned about what he will become tomorrow. In this perspective, the weight  $\alpha(t)$  attached to satisfactions at the date  $t - \alpha(t) = e^{-\delta t}$  – measure the extent and significance of these projects and can be interpreted as a sort of altruism of the present self towards the future self at time  $t$ .

Experimental measures on temporal distances of one year at the very most have no chance of approaching such a conception of time preference. Subjective Likert scales, on the other hand, built in the same way as those for risk, where the subject is asked to evaluate himself on a scale ranging from 0 ("living from day to day") to 10 (very concerned about the future"), provide information that is more relevant, although it may lack precision. Thus, Ameriks *et al.* (2003) use a purely qualitative question about the "propensity to plan" which provides indirect but usable information about the (reverse of) preference for the present; suitably instrumented to correct for endogeneity bias (*i.e.*, owning wealth predisposes towards a long-term view), this variable has non-negligible, positive effects on the levels of total and financial wealth in the United States.

To sum up, the preference for the present – such as we define it – is better measured on the basis of a series of practical questions, directly related to the lives of the subjects, and which directly concern their decision-making horizon (rather than choices of the kind "one today or two tomorrow").

#### 4. An original "scoring" method

So what can we conclude about the usual measures of savers' preferences? Firstly, few if any of the studies collect information simultaneously on all three types of preferences – with regard to risk, time and children – to estimate their respective effects on the level and composition of wealth.<sup>16</sup> Secondly, the evaluations of time preference proposed in the literature are clearly inadequate and we have just indicated the procedure to follow to obtain more suitable estimations.

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<sup>16</sup> Even studies that examine risk and time preferences at the same time are thin on the ground: Barsky *et al.* (1997) and Dohmen *et al.* (2010 and 2011) are exceptions, but in both cases the measures of time preferences are not very satisfactory. Even the recent survey by Guiso and Sodini (2012) on Household Finance only deals with risk preferences.

#### **4.1. No single question is satisfactory in itself: in favour of *synthetic* measures of preferences**

The different measures of attitudes to risk may be more reliable, but they also pose problems. The experimental measures do little to explain the wealth management behaviour of households in the real world. Those that address financial choices or strategies often appear to be artificial and their effects on wealth are tainted by endogeneity biases. But choosing, for want of anything better, the domain of professional life, where risk-taking is typically lower than in the field of financial investments, appears to be a largely arbitrary decision. And yet this is the approach adopted by lotteries on permanent income, the most widely-used measure, of which the complicated and abstract nature probably explains the high instability of answers by one individual over time. And finally, although they appear to speak more to the subjects, self-reported scales lack an objective reference point (what does the value 5 signify on a scale of 0 to 10?) in relation to which the survey could position itself clearly.

In short, taken separately, none of the questions used to measure risk preferences and their effects on wealth is really suitable, because we do not know which area of life it is meant to relate to nor the general form it should take. If it is targeted on the theory, it appears to be too abstract and generates a vast amount of noise in the answers; if it is more practical or *ad hoc*, its interpretation remains too imprecise. Over and above attitudes to risk, this empirical conclusion has more general scope; it explains why our measures of preferences are based on a synthetic method of “scoring”.

We have already seen that the limitations of the theory justify a method of evaluation that is empiricist on two accounts: (1) the measures should concern all three types of preference in general, relating to risk, time and children, not one particular parameter; (2) provided that the statistical analysis can cover a sufficient number of diversified questions, the data will determine how many indicators should be introduced for each type of preference. The fact that no single question is sufficient in itself leads us to multiply them, in two ways:

(3) The questions will cover a wide range of areas of life, such as consumption, leisure activities, actual financial investments, work, family, health, retirement, etc.

(4) The questions will be of different natures and relate to different contexts: the most numerous, practical or relating to everyday life and relatively easy to answer, will ask the subjects about their actual behaviour, their opinions or their intentions; others will concern the subjects’ reactions to imaginary scenarios and more abstract lottery choices. Some will be relatively trivial, while others will address crucial decisions.

#### 4.2. *PATÉR*-1998 (INSEE): the development of synthetic, ordinal “scores”

Justified by both the limitations of theory and the empirical difficulties of questioning, the method of measuring preferences that we have developed, doubly empiricist and synthetic, consists in constructing aggregate, relative scores that summarise as faithfully as possible the information provided by the answers of the respondents to this set of questions.<sup>17</sup> It was initially developed on data for a subsample of a thousand households from the INSEE “Patrimoine 1998” survey, on the basis of more than one hundred questions. It was reproduced for the *PATÉR* 2002 survey conducted by TNS Sofres, with the specific objective of measuring the degree of intergenerational transmission of preferences, and it has been repeated, with minor improvements, in the last three *PATÉR* surveys of 2007, 2009 and 2011.

The qualitative scores that we construct are intended to “profile” individuals according to their tolerance to risk, their attitude to the future and the degree of altruism towards their children, on the basis of questions that are practical and therefore sometimes trivial – such as whether the individual carries an umbrella when the weather is uncertain, or parks illegally (see below). At the same time, this method has nothing to do with the quizzes in glossy magazines which claim to tell you “what sort of person you are” simply by using *ad hoc* criteria to classify you. The very existence of the scores we are seeking is uncertain at the outset. For these scores to be possible, two conditions must be satisfied:

- firstly, a given series of questions - concerning risk, for example – must effectively possess a *common dimension* which can be obtained by aggregating the replies, beyond framing effects, measurement errors, etc.: the score obtained must therefore have a minimum degree of internal consistency, measured by psychometric tests;
- secondly, the preference scores obtained must explain, in a significant and “reasonable” manner (in keeping with theoretical predictions), the wealth management behaviour identified elsewhere in the survey: on this particular point as on others (endogeneity bias, temporal self-correlation, statistical properties, explanatory factors, etc.), the scores must perform markedly better than the usual measures based on lotteries, scales or experiments.

##### *A method of scoring in three stages, judged by the data*

Initially, therefore, the method tested on the first wave of the *PATÉR* survey in 1998 (Arrondel, Masson and Verger, 2004) presented numerous methodological uncertainties, which could be found in each of its three stages:

- (i) the choice of questions and their *a priori* allocation to one of the three fields of preference, concerning risk, time or children:

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<sup>17</sup> Our approach thus rejoins the multidimensional analysis of personality traits pioneered by psychometricians and recently taken up by economists, around Heckman (see Borghans *et al.*, 2008).

- how many questions are needed to measure preferences and obtain scores that explain wealth management behaviour: 20, 30, 40, 50? It would be ideal if a small number of carefully chosen questions was sufficient;

(ii) coding the answers, for which we have chosen a system with three modes. In the case of the preference for the present, for example: short-sighted:  $-1$ ; medium-sighted:  $0$ ; far-sighted:  $+1$ ; the “raw” score for each individual, before validation, is then equal to the *sum* of the scores obtained for all the questions initially considered:

- is this critical procedure of aggregating the replies into a non-weighted total optimal? Or should we increase the number of modes, as is usually the case in psychometric studies?<sup>18</sup>

(iii) statistical validation and correction of the “raw” scores: the final scores, *if they exist*, are obtained from the corresponding raw scores by limiting the sum total to those items that are seen, *ex post*, to form a statistically consistent whole.<sup>19</sup> A score is only satisfactory *a priori* if it presents a minimum degree of internal consistency, which is estimated by Cronbach’s alpha; principal component analysis (PCA), applied to all the questions envisaged to construct each score, can be used to verify its representativeness (see Appendix 2):

- in a given field of preference, is it legitimate to consider the answers to trivial and crucial decisions, or small and big risks, on the same level, by aggregating them, or should separate scores be used in each case?
- are attitudes to risk and the future sufficiently homogeneous in the different areas of life (health, family, work, retirement, etc.) for us to summarise them in a synthetic score? After all, hang-gliding and tax fraud are risky activities with very different motivations; and some individuals make substitutions between the risks they take in different areas.<sup>20</sup>

It can be seen that the possibility of our scoring system failing could not be excluded *ex ante*: analysis of the INSEE data might well have concluded that there was no acceptable score for risk, for example, or far too many. But rather than condemning our method, which we have shown to be superior to other measures, this failure would have meant that the objective of estimating savers’ preferences in order to evaluate their effects on wealth management behaviour faced considerable difficulties: unobserved heterogeneity in this behaviour could still be identified (on panel data) but it would remain a black box.

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<sup>18</sup> Sensitivity tests show that the number of modalities used in the coding system has little effect on the results obtained provided the number of questions considered in the score exceeds a certain threshold.

<sup>19</sup> Each item retained must have a minimum positive correlation with all the other questions for the score considered.

<sup>20</sup> Thus, a (French) dragster world champion declared that because he took extreme risks in his professional life, he was very careful in managing his wealth for himself and his family, looking after his health, etc.

*Choice of questions: an anthology*

By giving a few examples of the questions used in the *PATÉR*-1998 survey to characterise risk and time preferences, we will see that none of them is satisfactory in itself, for various reasons.<sup>21</sup>

The questions that characterise a preference parameter directly are too abstract: “You are offered the chance to buy for 500 francs a lottery ticket which has a one-in-a-thousand chance of winning 1 million francs. Do you buy it?” (absolute risk aversion); “Due to an unexpectedly heavy workload, your employer asks you to postpone one week’s holidays for a year, in return for an extra  $X$  days off...” (time discount rate).

Other questions concern a type of preference, but cannot be related to a specific parameter (rational or not): “Has your consumption of meat changed since the problems of mad-cow disease?” (risk);<sup>22</sup> “Do you agree with the following statements: “marriage is a form of insurance”, “deciding to have children means taking a risk” (risk); “deciding to have children is a life-long commitment” (time); “With regard to your young or teenage children, are you (or would you be) the sort of person: “to encourage them to take risks?” (risk); “to give them a taste for saving?” (time).

Certain questions have been allocated *a priori* to more than one type of preferences, particularly as regards risk and time – overlapping is inevitable because the future is both uncertain and far-removed from the present: “Do you think it is worth forgoing one of the pleasures of life, in order to live a few years longer?”; “To avoid health problems, do you watch your weight or your diet, do you practice a sport...?”; “Instead of the current system, you are offered the following: a higher pension until the age of 85, but then the minimum social security pension after that. Would you accept?”

Moreover, many questions dealing with everyday life pose problems in how to interpret the replies; because of framing effects and non-relevant factors that cannot be controlled: answering “yes” to the question “Do you ever park your car illegally?” tends to express a tolerance to risk, but a risk-loving individual may well refuse ever to park illegally through civic-mindedness.

Other questions only have an indirect link with a type of preference. In terms of risk, for example: “Do you ever go to a show rather at random, at the risk of being disappointed on occasion?”; “Are you sensitive to current health debates (AIDS, contaminated blood, etc.)?”

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<sup>21</sup> To get a more precise idea of the content of the scores, the reader will find in Tables 2 and 3 below, the fifteen questions that contributed the most to the risk and time preference scores for the waves 2007 and 2009 (many of the questions were repeated from the 1998 wave).

<sup>22</sup> This question was withdrawn after 2007 because it had less relevance for the younger generations.

Many questions are – deliberately – so trivial that taken separately, one would not expect them to have any effect on the level or composition of household wealth. Thus, in terms of risk: “When you leave the house and the weather is uncertain, do you take an umbrella or a raincoat?”; or again: “When you are driving, do you ever: not wear your seat-belt... exceed the speed limit... go through an amber light?” However, we will see that these questions are among the ones that contribute the most to the risk score, and they are therefore perfect instruments.

Conversely, some questions have a significant effect on the level of wealth but suffer from obvious endogeneity bias: “Do you ever have difficulty making ends meet?” (time); “In couples where there is one main money-earner, do you think that it is necessary to plan financially for his or her possible disappearance (by taking out life insurance or putting enough money aside)?”<sup>23</sup>

So in terms of both the measurement of preferences and their explanatory power on wealth management choices, the questions asked suffer from obvious biases and shortcomings. The idea underlying the second and third stages of the scoring method is that only the “average” of all the replies given to a wide diversity of questions will have meaning, because this aggregation eliminates, globally and *ex ante*, the biases and parasitic measurement errors. The scores, which are qualitative ordinal measurements, are therefore intended to be indicators of a series of opinions, intentions, behaviours or reactions to hypothetical scenarios concerning one of the three types of preference: attitudes to risk or uncertainty; priority given to the present; family altruism. The third stage, of statistical validation, must then determine the number of different scores to be introduced for each type of preference, if such scores can indeed be obtained.

#### **4.3. The results of PATER-1998: 4 scores of preference are sufficient**

We will now summarise the results presented in an earlier issue of *Économie et Statistique* (Arrondel, Masson and Verger, 2004).

In terms of risk, 54 of the 56 questions initially considered were kept, enabling us to construct a score for risk with a relatively high degree of internal consistency (Cronbach’s alpha of 0.65, see Table A1). This score displays the desired statistical properties, as regards the projection on the first axis of the PCA (the equivalent of graph A1 for 2007-2011), the regularity and the dispersion of the bar chart (graph A2), and the strong correlations between “sub-scores” calculated for the different areas of life. Moreover, the individual determinants of this score (see Table 4 below) and its significant effects on the level and composition of wealth (the equivalent of graphs 1 and 2 for 2007-2011) go in the expected direction.

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<sup>23</sup> This question is the only one to have been attributed *a priori* to all three types of preference.

In other words, the INSEE data led us to conclude that one single score for risk was sufficient to characterise numerically the attitudes towards risk and uncertainty of a representative sample of French savers. In view of the multiplicity of dimensions of risk highlighted in the literature, this remarkable result was a real surprise, the only reservation being that it may not apply to sub-populations of experienced investors possessing a high level of financial wealth.

As regards the time preference for the present, on the contrary, two heterogeneous dimensions emerged very quickly, marking the contrast between the short term and impulsive choices on the one hand, and the long term and more reasoned decisions on the other. Two scores were retained:

- The first measured the preference for the present over the life cycle, with a Cronbach's alpha of 0.53 (Table A1), still acceptable if one bears in mind the difficulty, mentioned earlier, of bringing this preference closer to a "higher order", *a priori* time consistent; in fact, the statistical properties of this indicator, its determinants and its effects on wealth satisfy the required criteria as in the case of the score for risk.
- The second measured the degree of short-term impatience, which should incorporate not only the parameter  $\beta$  of hyperbolic discounting but also a time-consistent dimension linked to the high opportunity cost of time for certain individuals. However, this second score was poorly determined, with a Cronbach's alpha of only 0.27, below the standard threshold of relevance (about 0.4), because of the small number of questions used (8); this score does little to explain wealth management behaviour.

Finally, we retained one single score for altruism, but here again the degree of consistency was too weak because of the small number of questions considered; this score has significant effects, in the expected direction, on the level and composition of wealth.

Bearing in mind the need to increase the number of questions in order to improve the scores for short-term impatience and altruism, four scores were therefore sufficient for us to characterise savers' preferences. It remained for us to determine whether these indicators, in particular those concerning attitudes to risk and preference for the present over the long term, performed better than the usual measures. The answer will be given in detail below, after examination of the results for subsequent waves of the **PATÉR** panel. But let us already remark that the scores are much better explained by the observable characteristics of the surveys, and in the expected direction: for example, young people and men are more tolerant to risk; older and higher-qualified people are more far-sighted. Furthermore, and this is an original result, we were able to estimate a positive correlation between attitudes to risk and preference for the present: cautious individuals were more often far-sighted, and *vice versa*.

But above all, the scores were relevant in explaining the level and composition of wealth, because they do not suffer from the same endogeneity biases as the other measures. By

construction, these indicators are a collection of good instruments: knowing whether an individual “takes his umbrella when the weather is uncertain” tells us something about his tolerance to risk but nothing – fortunately – about his level of wealth.<sup>24</sup>

Applied to data from INSEE, this first experiment of measuring savers’ preferences by the original method of scoring was therefore an overall success. However, it calls for two observations.

- The method is only reliable when a large number of questions are considered. Only keeping the ten questions that contribute the most to the scores for risk of time preference, for example, considerably reduces the performance of the indicators concerned. INSEE’s understandable hope of being able to measure preferences on the basis of a few questions incorporated into the patrimony surveys therefore proved to be wishful thinking: the ideal would be to have a patrimony panel available and to be able introduce a module entirely dedicated to the estimation of preferences into one of the waves of the survey.

- The success of this first experiment must be put into perspective: because it is a “handmade” scoring method, the success of which depends entirely on the data considered, we cannot exclude the possibility that this success obtained on the INSEE survey was simply a “stroke of luck”. There is only one way to put this doubt to rest, and that is to multiply the sources of data on which the method can be replicated to test the robustness of the results obtained. This was the purpose of the subsequent *PATÉR* surveys, which also introduced a valuable panel dimension, notably to test the stability of preferences.<sup>25</sup>

## 5. *PATÉR*-2002 to 2011: consistency and robustness of the scoring method

The experiment was first repeated in 2002 with the specific project of questioning two generations simultaneously to analyse the intergenerational transmission of preferences. It is because the same questionnaire had to be presented to both parents and children that there were fewer questions and the scores therefore performed slightly less satisfactorily (see Appendix 2). Then in 2007, with a broader sample (3 800 households), the questionnaire was enriched with a large number of questions and an experimental part and, for some households, it was sent separately to each member of the couple. The experiment was repeated in 2009 and in 2011 with an important panel dimension (about 2000 households were present in the waves of 2007 and 2009, the same number in 2009 and 2011, and about one thousand in all

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<sup>24</sup> In fact, it emerged that the other measures of risk parameters (lotteries and scales), endogenous for explaining wealth management choices, could be instrumented by the scores in a very satisfactory manner.

<sup>25</sup> The scoring method could also be applied to other countries, by adapting the questions to the socio-cultural context of the country considered.



three waves) and questioning almost identical to that finally chosen in 2007, in order to observe the evolution in preferences and the reactions of savers during the crisis.<sup>26</sup>

These four surveys were conducted by TNS-Sofres on a panel of volunteers representative of the French population. The method of questioning was different to that used by INSEE for the *PATÉR*-1998 wave, since the respondents did not have to answer an interviewer face to face, but fill in a questionnaire on paper and send it back by post.

### 5.1. Still 4 scores of preference...

Comparative analysis of the results in the different waves of the survey confirm the main conclusions drawn from the initial data of *PATÉR*-1998. More precisely, the characteristics of the scores obtained display remarkable consistency and robustness between one wave and the next:

- The preferences of the saver can still be represented by *four consistent scores*: one score for attitudes to risk, two for time preference (short term and long term) and one for altruism.
- The scores possess a high degree of internal consistency, at least in the four surveys (1998, 2007, 2009 and 2011) for which the number of questions was not limited (see Table A1 in Appendix 2): the value of Cronbach's alpha for the score for risk is around 0.70 with 50 to 60 questions, which is the threshold of totally credible consistency for psychometricians; the corresponding value, close to 0.55, obtained for the score for time preference in these four surveys remains acceptable and expresses the greater difficulty in identifying this parameter of preference.
- The consistency of the scores can also be visualised on the circle of correlations of the PCAs carried out on the waves *PATÉR*-2007 to 2011 (Graph A1, Appendix 2). These graphs show that the scores (introduced as additional variables) are projected perfectly on the first axis, which represents risk-taking. It is also worth noting the great similarity between the projections of the different questions on the first two axes.
- Table A1 in Appendix 2 also lists the number of questions of which the different scores are composed. If there are too few questions, as was the case for *PATÉR*-2002, it is not possible to obtain indicators of sufficient quality.<sup>27</sup> In the case of altruism and short-term

<sup>26</sup> See Table 1. The wave *PATÉR* 2007 allowed us to subject our scoring method to different validation tests, by increasing the initial number of questions to determine the optimum composition of the scores, by trying to distinguish different scores for risk, by introducing an experimental protocol to obtain alternative measures of preferences (aversion to risk and ambiguity, preference for the present and short-term impatience) that can be compared with the scores, etc. The questions finally retained were repeated in 2009 and 2011.

<sup>27</sup> The validation tests (sort of crash tests) carried out on the 2007 wave showed that although a large number of questions is necessary to establish reliable scores, the additional information collected above a certain threshold becomes marginal and only very slightly increases the internal consistency of our measures: this threshold is about sixty questions in the case of risk, for example. The attempts to distinguish several scores for risk, by

impatience, the increase in the number of items considerably improved the performance of the two scores between 2007 and 2011, with a Cronbach's alpha above 0.4 for fifteen questions.

## 5.2. ... with the same content

So the scoring method developed on the different waves of the *PAT€R* survey allows to characterise the saver's preferences in 4 consistent scores. The question that remains is whether these indicators always measure the same thing. Several statistical observations suggest that this is the case, while highlighting the superiority of scores over the other measures of preferences:

- The bar charts of the scores display the required properties of dispersion and regularity, and they are, moreover, comparable from one survey to the next (see Graphs A2 and A3 in Appendix 2). These properties cannot be observed in the other measures: the risk aversion measure based on career lotteries (Barsky *et al.*, 1997) only has four modalities; the distributions obtained for the scales from 0 to 10 for time and risk preferences have chaotic profiles, with peaks that fluctuate in size and location between one survey and the next, notably in 0 and 5 (Graphs A4 and A5).
- The "content" of the scores is remarkably constant: the rankings of the questions that are most relevant in explaining the scores (those that contribute the most, in the sense that they have the highest correlation with the rest of the score) are very similar from one date to the next, as Tables 2 and 3 show, for example, for the first fifteen questions in the 2007 and 2009 waves. For the score for risk, the ranking of items that contribute the most is even invariant over the three years 2007, 2009 and 2011: 1. the precautions taken in the event of uncertain weather; 2. driving; 3. illegal parking. In the case of the score for time preference, the three questions concerning whether the savers (i) seek to give their children a taste for saving, (ii) think that retirement should be prepared for in advance and (iii) are concerned about their health and fitness come out top in all three surveys.
- The time correlation of individual preferences between 2007, 2009 and 2011 for example, is a good indicator of the consistency of measures from one survey to the next (Table A2). The self-correlation of scores is by far the highest: 0.75 over two years and 0.70 over four years for the risk score; 0.67 over two years and 0.60 over four years for the time preference score. The lottery of Barsky *et al.* (1997), on the contrary, presents the highest variability from one survey to the next, with a rank correlation that does not exceed 0.30; this variability can be

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separating the questions that could define a score for the aversion to ambiguity, for example, also proved to be fruitless.

explained notably by a certain inconsistency in the replies between the successive waves of the *PATÉR* survey (Table A3).<sup>28</sup>

The similarity between the empirical properties of the scores constructed from different waves of the *PATÉR* survey testify to the robustness of the method, both at the level of their statistical consistency and at the level of their information content. This robustness is a necessary step but not sufficient. The second step consists in showing (which was the initial aim of the research project) that these measures allow us both to understand the savers better and to better explain their wealth management behaviour, the idea being to bring to light the constancies in these two domains from one survey to the next.

### 5.3 Tastes and riches: the best-performing scores for explaining wealth

A systematic comparison of the different indicators of preference shows that our synthetic scores perform better than the usual measures, especially lotteries and scales, when it comes to explaining savers' preferences and wealth management choices:

- "Who is what in terms of preferences?": analysis of the individual determinants of the scores reveal effects of observable characteristics that are perfectly comparable between one survey and another and which generally go in the expected direction. Thus, men are more risk-tolerant than women and young people are more risk-tolerant than older ones. Married people and children of self-employed parents are also more risk-tolerant. On the other hand, the idea that education favours risk-taking is only confirmed in two surveys, the two others not revealing any significant result (Table 4). Furthermore, as one might have expected, the respondents are more likely to be far-sighted (have low time preference for the present) if they are older, more highly-educated or living in a couple. On the contrary, the idea that women are more far-sighted is only substantiated in the last three waves of the survey (Table 5).
- Original information from the *PATÉR* data, the correlations between the different scores of individual preferences are very similar from one survey to the next, as can be seen in Table 6, which compares the results obtained in 2007, 2009 and 2011: for example, lower risk tolerance goes with greater far-sightedness, with a correlation of the order of 0.40 for the three dates, but also with less impatience (correlation of the order of 0.35) and stronger

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<sup>28</sup> The numbers on the diagonal are far from being the highest except for the most risk-averse; above all, more than one third of the respondents who declared themselves to be very adventurous in one survey completely changed their opinion two years later and no longer accepted any risk. The same inconsistencies can be observed in the American data of Barsky *et al.* (1997), leading these authors to use the panel dimension (test-retest) to partly correct the measurement errors and noise in the replies given.

altruism (correlation of 0.30); the correlation between preference for the present and short-term impatience is positive but weaker (0.20-0.25).<sup>29</sup>

- If we apply to these scores the typology of savers obtained in the standard model by combining risk aversion and future discount rate, the positive correlation between risk aversion and far-sightedness means that the most frequent categories are the “Conservative investors” (cautious and far-sighted) and the “Hotheads” (risk-tolerant and short-sighted). The other types of savers, “Short-sighted prudent” and “Enterprising” constitute more original profiles. From the first wave of the survey (*PATÉR*-1998), we verified that combining the preferences noticeably improved their explanatory power on wealth behaviour (Arrondel, Masson and Verger, 2005): all else being equal, the “Conservative investors” accumulate substantially more than the others; conversely, the “Hotheads” possess less retirement savings than the others, and the ownership of shares appears to be weakest in the category of “Short-sighted prudent”.
- The quantitative effects of the scores on savings and portfolio choices are more significant than for the other measures and also very comparable from one survey to the next. Thus, the specific effect of the score of preference on the levels of total or financial wealth is significant and comparable in 2007, 2009 and 2011: between the first and last quartiles of the score distribution, financial wealth is multiplied by a factor of about 2 (Graph 1). The same is true for the specific effect on the possession of diverse assets which is obtained for an increase of one standard deviation between the different scores. As one might expect, lower risk tolerance has the strongest negative effect on the possession of shares: the probability of holding these assets, on average 18 %, falls by the same percentage in the two surveys, between 3 % and 4 %. Preference for the present has the strongest negative effect on life insurance and retirement savings. Altruism firstly favours the possession of life insurance. Lastly, home ownership and savings accounts decrease with risk tolerance and preference for the present (Graph 2).

Remember that these effects of scores on the level and composition of wealth have the decisive advantage of not suffering from the same endogeneity biases as the other measures of preference: by construction, the scores are synthetic indicators that largely resemble a collection of “natural instruments”.

#### 5.4. Prolongations: preferences and families

Several waves of the panel *PATÉR* allow to compare preferences within families, as in the most accomplished surveys outside France: Dohmen *et al.* (2012) on German data for self-

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<sup>29</sup> The correlations calculated on the INSEE data of 1998, obtained by interview rather than postal questionnaire, are perfectly comparable. Note that all these correlations concern “disconnected” scores, where common questions have been attributed to one single score (the one to which they make the strongest contribution).

reported scales from 0 to 10; and above all Kimball *et al.* (2009) on American data using the lottery on career choices. In *PATER*-2002, we questioned two generations in order to compare the preferences of parents and children; in *PATER*-2007, we presented the same questionnaire separately to the two spouses in the household.

*“Like father like son”: the intergenerational transmission of preferences*

In *PATER*-2002, the same questionnaire was presented to a sample of parents and children (410 pairs). This source thus supplied information on wealth and subjective characteristics for two coexisting generations.

We obtained positive intergenerational correlations, all else being equal, for the three scores of the attitude to risk, time preference and family altruism (Arrondel, 2009). The correlation was strongest for risk, between 0.22 and 0.30 depending on the populations considered; the correlation for time preference lay between 0.15 and 0.20; that for altruism varied between 0.11 and 0.20. Therefore, beyond the influence of the social context, religion, education, etc., there does indeed exist a specific effect of the family context, expressed in a significant heritability of preferences.

If we consider risk aversion as measured by the lottery of Barsky *et al.* (1997), on the contrary, the replies given by the two generations of the families questioned do not allow us to identify any significant correlation. Evidently, this measure has from too much noise.<sup>30</sup>

*Birds of a feather?*

Do men who are more risk-tolerant have spouses who are more risk-tolerant? Is the same true for other dimensions of individual preferences? In other words, do both members of a couple share the same values? The *PATER*-2007 survey allows us to shed some light on this question, as yet little discussed. In this survey, the same questionnaire was sent to each spouse (with a period of time between the two) for about one thousand volunteer couples (905 replies).

We observed a similarity between spouses in terms of attitudes to risk, whatever the indicators of preference used (Arrondel and Frémeaux, 2013). The “raw”, positive and significant correlation between individuals ranges between 0.20-0.30 for the lotteries and scales to 0.50 for the scores. This homogamy can also be observed in the preference for the present, with raw correlations of the same order.

Econometric analysis shows that this homogamy in terms of psychological profiles remains relevant even when we take into account other individual characteristics of the spouses such

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<sup>30</sup> The measures of preference based on self-reported scales are not available for the 2002 survey. The only intergenerational study to use such scales, for risk and trust, is the German study by Dohmen *et al.* (2012): these authors obtain positive, significant but limited correlations between the scales of the parents and those of the children.

as age, social position and origin, religion, etc.: the values of the correlations hardly change. It remains to determine whether this similarity in preferences is the result of an initial selection process or of homogenisation over time due to mutual influence. The fact that the correlations observed are as high in recent couples as they are in more long-established couples suggests that the former explanation is more relevant: from the perspective of savings preferences, choice of spouse really is a matter of taste.

## 6. A brief assessment of our scoring method

At the end of this long journey, it is reasonable to conclude that our scoring method is an overall success. This success is all the more notable since it was so uncertain at the outset, as we have explained: the data of the 1998 INSEE survey could have invalidated the method by showing that it is impossible to construct a limited number of preference scores with sufficient internal consistency and satisfactory explanatory power on wealth management behaviour.

With hindsight, the success of the method is based on two pillars:

- the procedure of aggregating the replies to highly disparate questions to produce synthetic ordinal scores, representative of all the respondent's answers;
- the remarkable robustness of the results obtained in five different surveys, which concerns a wide variety of tests, including criteria as precise as the ranking of questions that contribute the most to each score (Tables 2 and 3) or the degree of correlation between different preference scores (Table 6).

### 6.1. The key role of aggregating the replies to diverse questions

We have seen that no single question posed is satisfactory, leading to replies that contain numerous biases and errors of various origins. However, as long as a set of questions presents a common dimension, concerning the attitude to risk, for example, then this attitude can be isolated by aggregating the replies, provided that this produces a score with satisfactory internal consistency. In this case, the scoring method and psychometricians wager that the procedure of aggregation, suitably performed and controlled, can eliminate *ex ante* the noise from the replies given by the respondent.

The alternative, much more familiar to economists, consists in eliminating *ex post* the estimation biases and other noise from the measurements through repeated evaluations (test-

retest), for example in long panel data: this is what Kimball *et al.* (2008 and 2009) did with American data on the income lottery (see Appendix 1). As in our survey, a single evaluation calculated from this lottery, in four or six modalities, gives unsatisfactory results. However, econometric corrections - made possible by repeated evaluations for the same individuals - produce a measure of risk tolerance that performs much better. It can also be noted that the two approaches – our scoring method for risk and the lottery corrected for measurement biases – lead to convergent conclusions both for the correlations between spouses or between parents and children in terms of their attitudes to risk and for the stability of this preference over time.

For example, Kimball *et al.* (2009), estimate a correlation of 0.41 between spouses, 0.23 between a child and his mother and 0.14 between a child and his father for this preference: these values are comparable to those obtained with the score for risk on French data between spouses or between parents and children.

Without being able to draw definitive conclusions, it therefore seems that one can establish a certain equivalence between the correction of noise *ex ante* using a psychometric procedure, or *ex post* using an econometric procedure. At the same time, each method has its downside: ours requires a large number of questions; that of the American authors requires a long panel.

## 6.2. How to interpret the robustness of our scoring method?

Established over five surveys with partly very different data sources (INSEE vs. TNS Sofres), the robustness of our scoring method is verified according to several different criteria: the number of scores, their internal consistency index, the numbers of questions retained and most relevant items, correlation between the scores, the explanatory power of these exogenous indicators on household wealth behaviour, etc. The method is therefore tried and tested. But the most interesting use of this robustness lies in the future. The fact that the method's success depends closely on the data used is no longer a weakness but a valuable asset.

Let us suppose that another wave of the *PATÉR* survey is carried out next year, under the same conditions as those of 2007, 2009 and 2011, with the same questioning and comparable data reliability. And let us imagine that this time, the scoring cannot be applied in the same way: several different scores need to be distinguished for risk, or worse, it is no longer possible to construct a satisfactory risk score for part of the population. This failure would be very instructive: given the success and robustness of the method on previous surveys, it would be evidence of a *structural* change in the behaviour of savers: not only would the crisis have changed the world in which individuals operate, making it appear more uncertain and instable

to them, but over time it would have seeped into their psyche, altered their identity, modified their decision-making mindset.<sup>31</sup>

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<sup>31</sup> This change would be all the more remarkable since, as Arrondel and Masson (2013) showed, savers' time and risk preferences remained generally stable from May 2007 through to November 2011.



## Bibliography

- Akerlof G.A. (1991), "Procrastination and Obedience", *The American Economic Review, AEA Papers and Proceedings*, 81 (2), p. 1-19.
- Ameriks J., Caplin A. and Leahy J. (2003), "Wealth Accumulation and the Propensity to Plan", *Quarterly Journal of Economics*, 118(3), 1007-1047.
- Arrondel L (2009), ""Mon père avait raison": la transmission des valeurs entre les générations", *Revue Française d'Economie*, XXIV, 157-205.
- Arrondel L and Fremeaux, N. (2013), "For richer, for poorer: savings preferences and choice of spouse", PSE Working Papers n°2013-02.
- Arrondel L. and Masson A. (2011), *L'épargnant dans un monde en crise : ce qui a changé*, Cepremap, 23, Éditions de la rue d'Ulm, Paris.
- Arrondel L. and Masson A. (2013), "Mesurer les préférences des épargnants : Comment et pourquoi ?", Working Paper, PjSE.
- Arrondel L., A. Masson and D. Verger (2004), "Préférences de l'épargnant et accumulation patrimoniale", (dossier of 5 articles), *Economie et Statistique*, n° 374-375.
- Arrondel L., A. Masson and D. Verger (2005), "Préférences face au risque et à l'avenir : types d'épargnants", *Revue Economique*, n°56 (2), 393-416.
- Barsky, R.B., Kimball, M.S., Juster, F.T. and Shapiro, M.D. (1997), "Preference Parameters and Behavioral Heterogeneity: An Experimental Approach in the Health and Retirement Survey", *Quarterly Journal of Economics*, 112 (2), p. 537-580.
- Beauchamp, J., Cesarini, D., and Johannesson, M. (2011). "The psychometric properties of measures of economic risk preferences", mimeo.
- Becker G.S. and Murphy K.M. (1988), "A Theory of Rational Addiction", *Journal of Political Economy*, 96 (4), p. 675-700.
- Borghans, L. Duckworth, A. L.; Heckman, J. J. and ter Weel, B. (2008), "The Economics and Psychology of Personality Traits", *Journal of Human Resources*, 43(4): 972-1059.
- Carroll C. D., (1992), "The Buffer-Stock Theory of Saving: Some Macroeconomic Evidence", *Brookings Papers on Economic Activity, Economic Studies Program*, The Brookings Institution, vol. 23(2), pages 61-156.
- Cohen M., Tallon J.-M. and Vergnaud J.-C. (2010), "An experimental investigation of imprecision attitude and its relation with risk attitude and impatience", *Theory and Decision*, vol. 71(1), pages 81-109.
- Deaton A.S. (1992), *Understanding Consumption*, Clarendon Press, Oxford.
- Dohmen T., Falk A., Huffman D. and Sunde U. (2010), "Are Risk Aversion and Impatience Related to Cognitive Ability?", *American Economic Review*, 100 (3), p. 1238-1260.
- Dohmen T., Falk A., Huffman D., Sunde U., Schupp J. and Wagner G. (2011), "Individual Risk Attitudes: New Evidence from a Large, Representative, Experimentally, Validated Survey", *Journal of the European Economic Association*, 9 (3), p. 522-550.
- Dohmen T., Falk A., Huffman D. and Sunde U. (2012), "The Intergenerational Transmission of Risk et Trust Attitudes", *Review of Economic Studies*, vol. 79(2), pages 645-677.
- Frederick S., Loewenstein G and O'Donoghue T. (2002), "Time Discounting and Time Preference: a Critical Review", *Journal of Economic Literature*, 40, p. 351-401.

- Guiso, L. and Paiella M., (2008), "Risk Aversion, Wealth, and Background Risk", *Journal of the European Economic Association*, vol. 6(6), pages 1109-1150.
- Guiso, L. and Sodini, P., (2012). "Household Finance: An Emerging Field", CEPR Discussion Papers 8934, C.E.P.R. Discussion Papers.
- Guiso, L. Sapienza P and Zingales, L. (2011), "Time Varying Risk Aversion", mimeo.
- Holt C. and Laury S. (2002), "Risk Aversion and Incentive Effects", *American Economic Review*, 92 (5), p. 1644-1655.
- Iezzi, S. (2008), "Investors' Risk Attitude and Risky Behavior: a Bayesian Approach with Imperfect Information", Bank of Italy Working Paper 692.
- Kahneman D and Tversky A (1979), "Prospect Theory: An Analysis of Decision under Risk", *Econometrica*, 47, p. 263-291.
- Kapteyn A. and Teppa F. (2011), "Subjective Measures of Risk Aversion, Fixed Costs and Portfolio Choice", *Journal of Economic Psychology*, vol. 32(4), pages 564-580.
- Kimball M., Sahm C. and Shapiro M. (2008), "Imputing Risk Tolerance from Survey Responses", *Journal of the American Statistical Association*, 103 (483), p. 1028-1038
- Kimball M., Sahm C. and Shapiro M. (2009), "Risk Preferences in the PSID: Individual Imputations et Family Covariation", *American Economic Review Papers et Proceedings*, 99 (2), p. 363-368.
- Laibson D. (1997), "Golden Eggs and Hyperbolic Discounting", *Quarterly Journal of Economics*, 112, p. 443-477.
- Modigliani F. (1986), "Life Cycle, Individual Thrift and the Wealth of Nations", *American Economic Review*, 76 (3), p. 297-313.
- Masson A. (2010a), "La vie pour l'épargnant ne se réduit pas à un exercice de calcul : 1. Les impasses des approches du cycle de vie standard et psycho-économiques", *Revue française d'économie*, XXV (1), p. 117-173.
- Masson A. (2010b), "La vie pour l'épargnant ne se réduit pas à un exercice de calcul : 2. Les apports d'une approche existentielle du cycle de vie", *Revue française d'économie*, XXV (2), p. 3-57.
- de Palma, A. and N. Picard (2012), "Le questionnaire de risque : pièce maitresse du conseil en investissement", *L'AGEFI actifs*, n° 556, p. 22-23.
- Sahm C. (2008), "Stability in Risk Preference", Finance and Economics Discussion Series 2007-66. Washington: Board of Governors of the Federal Reserve System.
- Shefrin H.H. and Thaler R.H., "The Behavioral Life-Cycle Hypothesis", *Economic Inquiry*, 26, p. 609-643.
- Von Gaudecker H.M., van Soest A. and Wengström, E. (2011), "Heterogeneity in Risky Choice Behaviour in a Broad Population", *American Economic Review*, 101(2): 664-94.
- Weber E., Blais A.-R. and Betz N. (2002), "A Domain-specific Risk-attitude Scale: Measuring Risk Perceptions and Risk Behaviors", *Journal of Behavioral Decision Making*, 15, p. 263-290.
- Weber M., Weber E. and Nosi A. (2013), "Who Takes Risks When and Why: Determinants of Changes in Investor Risk Taking", *Review of Finance*, 17(3): 847-883.
- Ziegelmeier M. (2010), "Are Survey Measures of Risk Attitudes Stable over Time?", mimeo, MEA, Mannheim.

## Appendix 1

The experiment based on the lottery of Barsky *et al.* (1997) was repeated while slightly varying the questioning (more contracts proposed, titles changed) in successive waves of the HRS panel from 1994 to 2002 (every two years except 1996), thus allowing a subsample of subjects to be followed over time.

Kimball *et al.* (2008) used this information to correct the noise in the (continual) measure of risk aversion econometrically. This noise stems from a *status quo* bias which encourages individuals not to want to change jobs and therefore to opt for the safe choice, an individual error that is systematic in the replies to different waves and transitory in the choices of each wave. Taking into account these errors brings to light the significance of the initial bias: the corrected risk tolerance is 11 % higher than the original measure. Furthermore, using this measure of risk aversion corrected for different biases increases its explanatory power on the demand for risky assets and decreases that of the other correlated factors (gender and education, in particular).

Beauchamp, Cesarini and Johannesson (2011) draw the same conclusion on Swedish data with the same measure of risk aversion: a retest on a subsample of individuals (500 out of 11000) shows that the correction of measurement errors (transitory variation) considerably increases the explanatory power of the lottery on risky behaviour. Moreover, the econometric relation between risk aversion and individual determinants is stronger with the corrected variable. Likewise, the correlation of preferences between brothers and sisters is stronger.

Sahm (2008) uses the HRS data to study changes in risk preferences over time (by “stacking up” the 18 600 replies of some 12 000 people). As before, the results show strong individual heterogeneity in risk tolerance (notably according to gender, ethnic origin or religion) and systematic changes over time such as age (decrease) and favourable macroeconomic changes (increase). On the other hand, the other changes in individual situations (unemployment, divorce, illness, etc.) do not affect the disposition towards risk.<sup>32</sup> Finally, contrary to systematic variations, the largest share of transitory variation in replies to the lottery remains unexplained. Individual risk preferences are therefore found to be stable.

Kimball *et al.* (2009) use the 1996 wave of the American PSID, the questionnaire of which includes the same lottery. They find a strong age effect, this time estimated on the whole population. Moreover, since all the members of a same family were questioned, they obtain

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<sup>32</sup> This result contradicts the more recent results of Guiso *et al.* (2011), who draw on the instability of replies to the lottery before and after the crisis to conclude that Italian savers have become more risk-averse. This reduction in risk tolerance, which cannot be explained by changes in the economic situation of the individuals, is attributed to “fear”. If confirmed, this effect would tend to show above all that this question is sensitive to passing emotions and therefore subject to instability.

interesting new correlations for risk aversion: the correlation is positive and significant between spouses (0.41), between brothers and sisters (0.48), and between children and each of the parents (0.23 with the mother and 0.14 with the father).

## Appendix 2

### Numbers of items and consistency index of preference scores

Table A1 presents, for each wave of the *PATER* survey and for each preference parameter (risk, time preference, altruism and impatience), the number of questions retained in the scores from among all the questions used in the questionnaire, together with the internal consistency index – Cronbach's alpha.

The score is most consistent for the attitudes to risk, since it is close to 0.70 in all the waves except *PATER*-2002, where the number of available questions was much lower, in view of the difficulty of the exercise: comparing the scores of the parents and the children. In the *PATER*-2007 survey, a larger number of questions were tested, notably concerning attitudes to risk: the statistical treatments show that above about sixty questions, the marginal contribution of an additional item hardly increases the consistency and relevance of the score.

The internal consistency of the score for time preference is weaker than that of risk (Cronbach's alpha reaches 0.55 at most), which shows that this parameter concerning a preference "of a higher order" is indeed more difficult to capture.

The score for altruism and impatience are constructed with a much smaller number of questions, which partly explains the relative weakness of the consistency index, varying positively with both the number of items and their covariance. From 2007, however, a doubling in the number of questions (about fifteen) led to more acceptable values of Cronbach's alpha (0.45).

### Principal Components Analysis of the score for risk

Graph A1 displays, for the waves *PATER*-2007 to 2011, the projection of all the questions considered to construct the score for risk in the circle of correlations defined by the first two axes of the PCA. We have also projected, as an extra variable, the selected score for risk (in four quartiles).

The three graphs show that the projection of scores is aligned with the first axis, for all the surveys. Therefore, the questions do indeed share a common dimension in relation to risk taking. Note also that the items most highly correlated with the score are those that best explain the first axis. Conversely, the items closest to the centre of the circle of correlations are the ones that contribute the least to the score, or which have even been eliminated.

So the information provided by the score is very close to that given by the first axis of a PCA of the questions considered to measure individual attitudes to risk.

### **Bar charts of preference measures**

Graphs A2 and A3 represent the distributions of the scores for risk and time preference based on the data from the waves *PATÉR*-2007 to 2011. They show a strong similarity in distributions between different years for attitudes to risk and time preference. Compared with other measures of preferences - lotteries (see Table A3) or scales (see Graphs A4 and A5) -, which only allow to classify the population into a few categories, we can see that the scoring method achieves distributions of individual preferences with a much broader spectrum and a smoother form: Graphs A4 and A5, representing the distributions of scales of risk and time preference, are much more erratic, with peaks on focal values (notably 5).

### **Content of the preference scores**

Tables 2 and 3 list, in the surveys *PATÉR*-2007 to 2011, for risk and time preference, the fifteen questions that contribute the most to the scores (the most highly correlated with the rest of the scores). The “content” of the scores appears to be very comparable, since the rankings of most the questions most relevant to explaining preference measures are very similar from one year to the next. For attitudes to risk, for example, the top three questions appear in the same order in all three waves.

### **Time correlations of preference measures**

Table A2 gives us some idea of the consistency of preference measures from one wave to the next for the same individuals (panel samples). It is the scores which have the strongest time correlations: nearly 0.75 between two years, and still 0.70 between *PATÉR* 2007 and 2011. The time correlations are weakest for scales and lotteries, revealing stronger variability in the replies to the questions by the same respondents. Table A3 showing the distribution of the population according to the replies to the lottery of Barsky *et al.* (1997) provides a striking illustration: more than one third of the most risk-loving individuals were no longer risk-loving two years later. Although the time interval (2 years) is quite long, this instability shows the inability of the lottery method to pass the test-retest hurdle.

**Table 1 : Available *PATÉR* surveys**

	<b>Insee 1998 (methodological survey)</b>	<b>Sofres 2002 (35- 55 years old)</b>	<b>Sofres 2007</b>	<b>Sofres 2009</b>	<b>Sofres 2010</b>
<i>Sample size</i>	1 135	2 460	3 826	3 783	3 616
<i>Specific characteristics</i>	-	2 adult generations interviewed (440 pairs parents- children)	Panel 2002-2007 (798 observations)  2 spouses interviewed (905 couples)	Panel 2002-2007- 2009 (600 observations)  Panel 2007-2009 (2234 observations)	Panel 2007-2009- 2011 (1087 observations)  Panel 2009-2011 (1970 observations)
<i>Number of questions for the scores</i>	80	50	115	90	90
<i>Risk lottery on income (Barsky et al., 1997)</i>	-	Yes	Yes	Yes	Yes
<i>Scales</i>	Yes	-	Yes	Yes	Yes
<i>Experimental measures</i>	-	-	400 subjects	-	-

Source : *PATÉR* 1998-2002-2007-2009-2011

**Tables 2 : Top ten questions contributing to the risk score**

<i>Top ten 2009</i>	<i>Rank 2009</i>	<i>Rank 2007</i>	Risk tolerant	Risk averse	Neutral
<b>Takes precautions in case the weather turns out nasty</b> (Yes = + 1 ; no = - 1 ; other= 0)	1	1	44,7 45,8	53,3 52,8	2,0 1,4
<b>Wears seatbelt, respects speed limit, respects traffic light</b> (Yes, very often, often = - 1 ; no, never or rarely = + 1 ; other = 0)	2	2	17,5 14,9	32,3 37,0	50,2 48,1
<b>Parks in forbidden zones</b> (Yes, very often, often = - 1 ; no, never or rarely = + 1 ; other = 0)	3	3	8,1 8,2	53,1 36,9	38,8 55,0
<b>Sacrifice today pleasures of life in order to live longer</b> (Yes = + 1 ; no = - 1 ; other= 0)	4	6	7,1 7,6	16,3 16,2	76,7 76,2
<b>Thinks that homogamy explains longevity of the couples (same income, social origin, political orientation, religion, tastes...)</b> (Yes strongly= + 1 ; no, not really = - 1 ; other = 0)	5	7	23,5 26,3	33,6 31,3	42,9 42,4
<b>"Marriage is an insurance policy"</b> (Yes = + 1 ; no = - 1 ; other= 0)	6	8	17,7 20,9	10,5 9,0	71,8 70,1
<b>"Home ownership ensures that you will always have a roof over your head"</b> (Yes = + 1 ; no = - 1 ; other= 0)	7	4	16,9 14,8	35,7 34,3	47,4 51,0
<b>Recommends to close to take risks in their career</b> (Yes, often = + 1 ; no = - 1 ; other= 0)	8	12	10,0 16,0	6,1 4,8	83,1 79,3
<b>Has taken risks in their career, and/or sports and/or sexual activities</b> (Yes, often = + 1 ; no = - 1 ; other= 0)	9	9	24,4 22,2	33,9 36,7	41,7 41,1
<b>Have practiced the following sports : off-piste skiing, parapenting, microlighting, parachuting, bungee jumpin, mountaineering, rock-climbing, rafting or canyoning, diving...</b> (Yes = + 1 ; no = - 1 ; other= 0)	10	5	18,3 17,2	52,6 55,9	29,1 26,9

Source : PATER 2007 and 2009



**Tables 3 : Top ten questions contributing to the time preference score**

<i>Top ten 2009</i>	<i>Rank 2009</i>	<i>Rank 2007</i>	<i>Live from day to day</i>	<i>Farsighted</i>	<i>Neutral</i>
<b>"Retirement has to be prepared well in advance"</b> (Yes = - 1; no, I have time = + 1 ; other = 0)	<b>1</b>	<b>2</b>	<b>21,3</b> <b>24,4</b>	<b>21,7</b> <b>21,2</b>	<b>57,0</b> <b>54,4</b>
<b>Careful to keep in shape</b> (Yes = + 1 ; no = - 1 ; other= 0)	<b>2</b>	<b>4</b>	<b>13,8</b> <b>15,5</b>	<b>21,6</b> <b>21,0</b>	<b>64,6</b> <b>63,5</b>
<b>We should teach children and teenagers how to save money</b> (Yes = + 1 ; no = - 1 ; other= 0)	<b>3</b>	<b>1</b>	<b>4,9</b> <b>4,3</b>	<b>43,4</b> <b>45,2</b>	<b>51,7</b> <b>50,5</b>
<b>Plan his holidays well in advance</b> (No = -1; Yes, well in time = +1; a little in advance = 0)	<b>4</b>	<b>6</b>	<b>12,6</b> <b>14,0</b>	<b>22,3</b> <b>20,0</b>	<b>65,1</b> <b>66,0</b>
<b>Sacrifice today pleasures of life in order to live longer</b> (Yes = + 1 ; no = - 1 ; other= 0)	<b>5</b>	<b>7</b>	<b>7,1</b> <b>7,6</b>	<b>16,3</b> <b>16,2</b>	<b>76,7</b> <b>76,2</b>
<b>Your children refuse to give up their leisure activities, hobbies or friends for their studies. Do you agree?</b> (Yes = + 1 ; no = - 1 ; other= 0)	<b>6</b>	<b>3</b>	<b>4,2</b> <b>4,8</b>	<b>37,2</b> <b>35,0</b>	<b>58,7</b> <b>60,2</b>
<b>I am someone who makes plans for the future</b> (No = +1; Yes = -1; Other = 0)	<b>7</b>	<b>11</b>	<b>31,6</b> <b>37,9</b>	<b>64,9</b> <b>59,6</b>	<b>3,5</b> <b>2,5</b>
<b>Would prefer early retirement against a lower pension after the age of 65</b> (No = -1; Yes = +1; Other = 0)	<b>8</b>	<b>10</b>	<b>27,1</b> <b>25,4</b>	<b>18,7</b> <b>23,2</b>	<b>54,3</b> <b>51,4</b>
<b>Does the possibility that you could end up your life in a nursing home preoccupy you ?</b> (Yes = - 1 ; other= 0)	<b>9</b>	<b>12</b>		<b>42,9</b> <b>44,2</b>	<b>57,1</b> <b>55,8</b>
<b>Buys transport tickets well in advance</b> (No = +1; well in advance = -1; a little in advance = 0)	<b>10</b>	<b>14</b>	<b>8,8</b> <b>8,3</b>	<b>27,7</b> <b>29,0</b>	<b>63,6</b> <b>62,7</b>

Source : PATER 2007 and 2009

**Table 4 : Determinants of the risk score**

<b>Risk score</b>	<i>PATÉR 1998</i>	<i>PATÉR 2002</i>	<i>PATÉR 2007</i>	<i>PATÉR 2009</i>	<i>PATÉR 2011</i>
Income	(-)	Non linear	Non linear	Non linear	Non linear
Age	+	+	+	+	+
Gender : female	+	+	+	+	+
Familial status	Married : +	Married : +	Married : +	Married : +	Married : +
Social origin	Self-employed : -		Self-employed : -	Self-employed : -	Self-employed : -
Education	-	0	-	0	0
Children at home	0	0	(-)	0	0
Children away from home	0		0	(-)	(-)
Numbers of observations	1 135	2 460	3 825	3 782	3 616

*Note : Variables statistically significant at 5% ; in ( ) at 10% . + : less risk tolerant*

*Source : PATÉR 1998-2002-2007-2009-2011*

**Table 5 : Determinants of the time preference score**

<b>Preference for the present</b>	<i>PATÉR 1998</i>	<i>PATÉR 2002</i>	<i>PATÉR 2007</i>	<i>PATÉR 2009</i>	<i>PATÉR 2011</i>
Income	0	-	-	-	-
Age	-	-	-	-	-
Gender : female	0	0	-	-	-
Familial status	Married: -	Married: -	Married : -	Married : -	Married : -
Social origin	0		0	0	1
Education	-	-	-	-	-
Children at home	0	(+)	(+)	(+)	0
Children away from home	(-)		0	0	0
Intergenerationnal transfers received	(-)	-	-	-	-
Numbers of observations	1 135	2 460	3 825	3 782	3 616

*Note : Variables statistically significant at 5% ; in ( ) at 10% . + : less far-sighted*

*Source : PATÉR 1998-2002-2007-2009-2011*

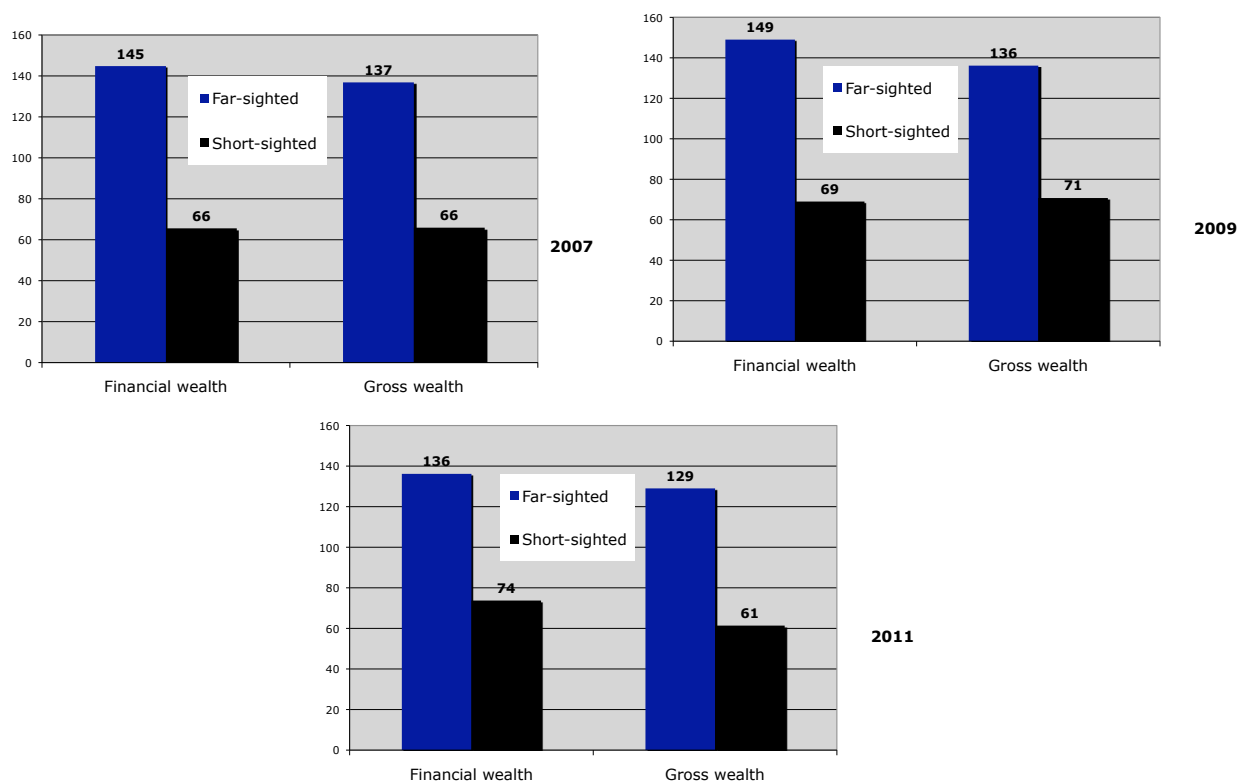
**Table 6 : Correlations between preference scores**

<b>Scores 2007</b>	Risk averse	Preference for the present	Impatient	Familial altruism
Risk averse	1,00	<b>-0,44</b>	<b>-0,33</b>	<b>0,30</b>
Preference for the present		1,00	<b>0,26</b>	<b>-0,30</b>
Impatient			1,00	<b>-0,11</b>
Family altruism				1,00
<b>Scores 2009</b>				
Risk averse	1,00	<b>-0,37</b>	<b>-0,34</b>	<b>0,33</b>
Preference for the present		1,00	<b>0,21</b>	<b>-0,25</b>
Impatient			1,00	<b>-0,16</b>
Family altruism				1,00
<b>Scores 2011</b>				
Risk averse	1,00	<b>-0,40</b>	<b>-0,36</b>	<b>0,29</b>
Preference for the present		1,00	<b>0,20</b>	<b>-0,29</b>
Impatient			1,00	<b>-0,12</b>
Family altruism				1,00

*Note : Correlations statistically significant at 5% level are in bold .*

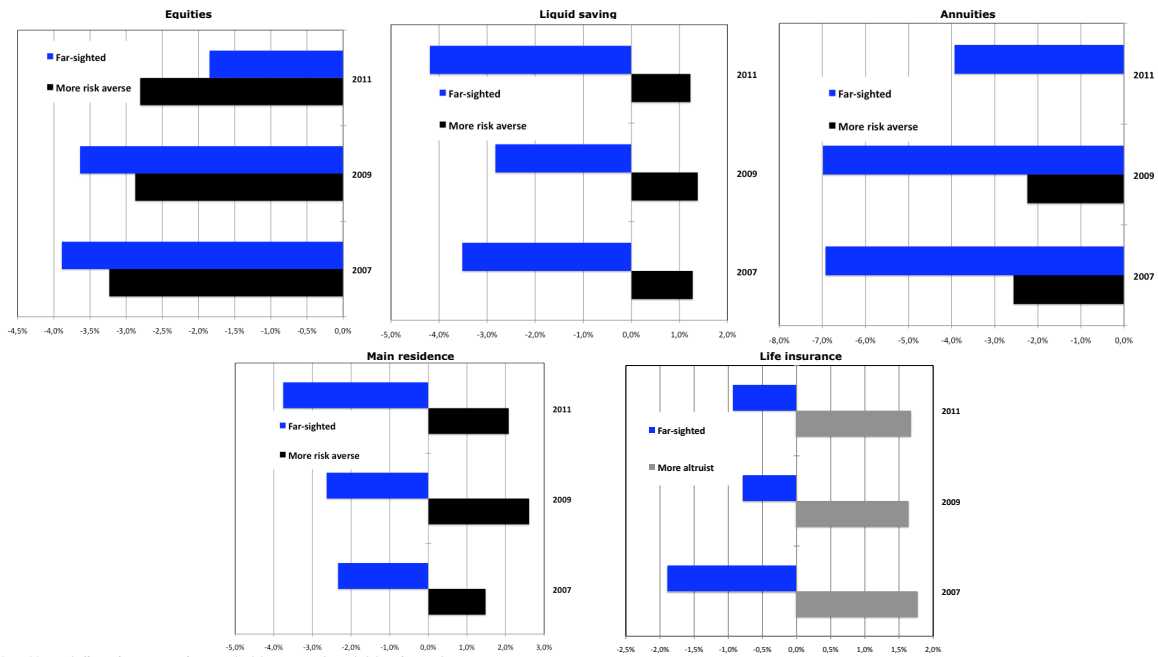
*Source : PAT€R 2007-2009-2011*

Figure 1 : Time preference score and wealth accumulation (econometric effects of scores between 1st and 4th quartile)



Source : PATeR 2007-2009-2011 (cross section data)

Figure 2 : Preference scores and portfolio choice



Note : Marginal effects of a variation of one standard deviation on the probability of ownership.

Source : PATCR 2007-2009-2011 (cross section data)

**Tables A1 : Cronbach's alpha of scores in the 4 *PATÉR* surveys**

<b>Survey</b>	<i>PATÉR 1998</i>	<i>PATÉR 2002</i>	<i>PATÉR 2007</i>	<i>PATÉR 2009</i>	<i>PATÉR 2011</i>
<b>Risk</b>					
Cronbach's alpha	0,65	0,51	0,68	0,67	0,66
Items retained/Total Items	54/56	27/32	57/65	52/58	53/58
<b>Time preference</b>					
Cronbach's alpha	0,53	0,40	0,56	0,54	0,54
Items retained/Total Items	25/34	16/18	27/34	23/30	23/30
<b>Family altruism</b>					
Cronbach's alpha	0,29	0,37	0,45	0,40	0,44
Items retained/Total Items	8/9	7/8	13/14	13/14	13/14
<b>Short term impatience</b>					
Cronbach's alpha	0,27	0,28	0,47	0,44	0,44
Items retained/Total Items	8/13	3/3	16/16	16/16	16/16

Source : *PATÉR* 1998-2002-2007-2009-2011

**Table A2 : Correlations of scores across waves**

	<i>2002-2007</i>	<i>2002-2009</i>	<i>2007-2009</i>	<i>2007-2011</i>	<i>2009-2011</i>
<b>Risk scores</b>	0.57	0.51	0.75	0,69	0,74
<b>Time preference scores</b>	0.46	0.36	0.66	0,60	0,67
<b>Risk lottery</b>	0.28	0.27	0.30	0,30	0,31
<b>Risk scales</b>			0.32	0,29	0,47
<b>Time preference scales</b>			0.54	0,49	0,53
<b>Number of observations</b>	798	600	2234	1 179	1 970

Source : *PATÉR* 1998-2002-2007-2009-2011

**Table A3 : Distribution across waves of the hypothetical lottery measure**

2009	Percent choosing response (%)				Number of observations
	2007				
	$\gamma>3,76$	$2=\gamma<3,76$	$1=\gamma<2$	$\gamma<1$	
$\gamma>3,76$	73,4%	41,4%	37,0%	<u>41,2%</u>	1061
$2=\gamma<3,76$	13,6%	38,1%	25,6%	12,8%	425
$1=\gamma<2$	10,2%	16,6%	29,8%	23,0%	320
$\gamma<1$	2,8%	3,9%	7,6%	23,0%	107
Number of observations	894	488	383	148	1913
2011	Percent choosing response (%)				Number of observations
	2009				
	$\gamma>3,76$	$2=\gamma<3,76$	$1=\gamma<2$	$\gamma<1$	
$\gamma>3,76$	74,2%	48,2%	37,4%	<u>34,5%</u>	1023
$2=\gamma<3,76$	14,2%	34,6%	30,7%	21,2%	358
$1=\gamma<2$	8,9%	13,0%	24,0%	25,7%	221
$\gamma<1$	2,8%	4,1%	7,9%	18,6%	82
Number of observations	979	338	254	113	1684

Source : PAT€R 2007-2009-2011



**Figure A1 : Principal Components Analysis of the risk score**

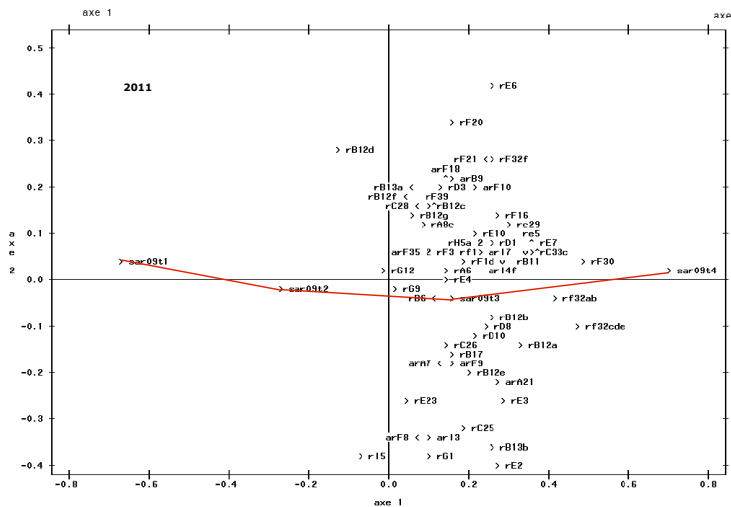


Figure A2 : Histogram of the risk score

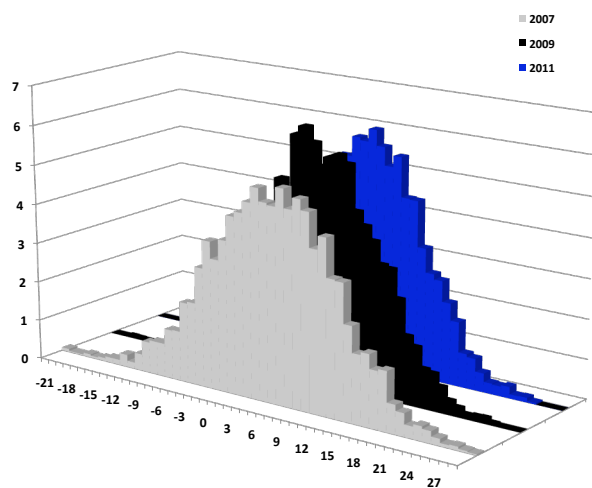
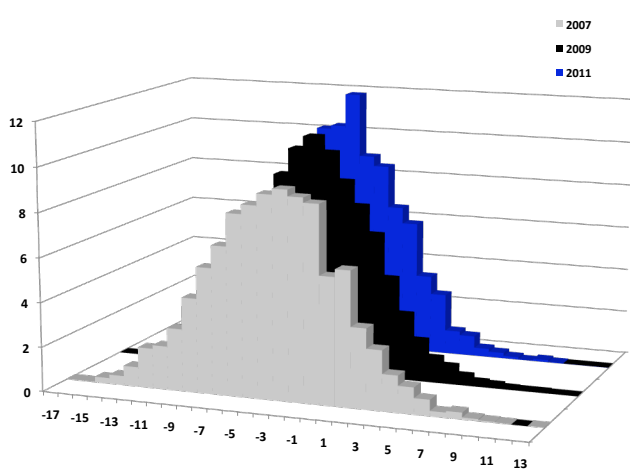


Figure A3 : Histogram of the time score



Source : PATeR 2007-2009-2011 (cross section data)

Figure A4 : Histogram of risk the scale

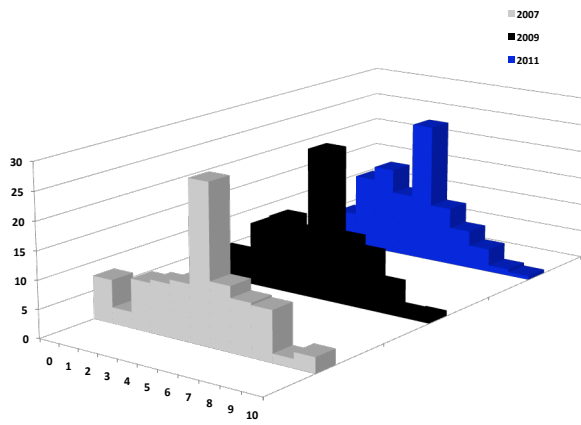
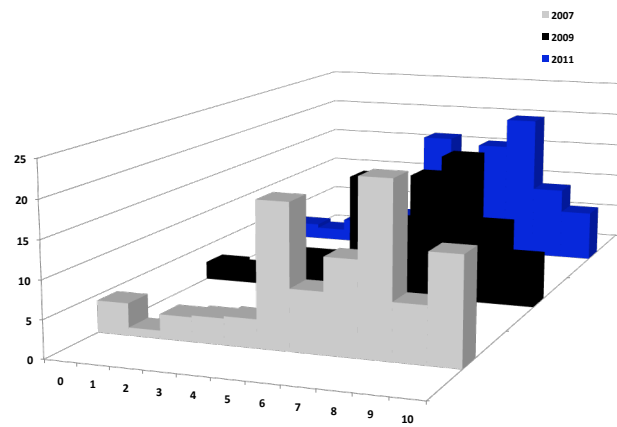


Figure A5 : Histogram of the time scale



Source : PATeR 2007-2009-2011 (cross section data)